blood, contains a great many round, indeed, chiefly round, corpuscles very similar to those of human blood, and it is often necessary to search a long while before an elliptical one is found. In human and mammalian dried blood, I have never found elliptical blood corpuscles."

After numerous and carefully conducted experiments, Friedberg[1] mournfully acknowledges "that the solution of the most difficult problem—the diagnosis of the blood of man and certain mammalia, in a dried state, as Schmidt has announced as positive in all cases—is still a *pium desiderium*, and it is not possible by the present known means of examination to distinguish them, as the results of the many systematic experiments I have made authorize me in saying."

Ritter,[2] in his well digested and carefully arranged prize essay, takes occasion to remark that "in his researches he has not found the facts as interpreted by Schmidt, and agrees with the conclusions of Friedberg."

From the experiments which I have made during a period of several years with blood belonging to different animals, when dried for a length of time and moistened again, I am forced to admit that great difficulty arises in attempting to fix its origin by the comparative size of the corpuscles; and again, that the blood of ovipara, when kept for several weeks, does not present the peculiar elliptical corpuscles found in fresh blood, in a form sufficiently perfect to justify me in declaring positively whence it proceeds.

Pittsburg, Pa., Oct. 20, 1858.

Art. VIII.—*On the Occurrence of a Blowing Sound in the Pulmonary Artery associated with Affections of the Lung; on the Sounds of the Artery in Health, and on the Effect on them and on the Heart of the Act of Inspiration.* By J. DaCosta, M. D., Lecturer on the Practice of Medicine at the Philadelphia Medical Association.

In examinations of the chest, I have met with a peculiar physical sign—a blowing sound in the second intercostal space on the left side—the occurrence of which has only been imperfectly alluded to, and the importance of which is not settled. The following notes of cases will explain its significance.

Case I. Wm. Moore, age 35, a clerk by profession, placed himself under my charge September 8, 1857, for phthisis. He belongs to a family in which consumption has made sad ravages; his father and grandfather, brothers and sisters, having died of the disease. He had had, when first seen, several hemorrhages; had lost flesh; and was troubled with a cough, followed by a yellowish expectoration. His pulse was 112, and feeble. The upper portion of the right lung was found dull on percussion, with crackling and prolongation of the expiratory murmur. On the left side, a slight dulness existed anteriorly at the upper portion, and the respiration was harsher than normal. It is not necessary here further to detail the case; it need only be added that he has remained under observation for upwards of a year, and that the most marked improvement, both in the symptoms and physical signs, has followed the administration of cod-liver oil and the iodide of iron. No advance of the disease has taken place in the left lung. During the period he has been under my care, I have repeatedly noticed that *a blowing sound*—at times low, at times of a higher and more whistling pitch—existed in the interspace between the second and third ribs on the left side. It was synchronous with the heart's impulse, and followed by a distinct second sound. In some examinations, in which the heart was beating slowly and the patient breathing quietly, it was not perceived, especially not at the last (in November, 1858). I do not, however, believe that it has disappeared entirely. The other sounds of the heart were perfectly normal, as was its impulse and the extent of the percussion dulness. No arterial or venous murmurs were noted.

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[1] Op. cit., s. 57.

[2] Ueber die Ermittelung von Blut, Saamen, und Exrementenflecken in Kriminalfællen. Würzburg, 1854, s. 139.

Case II. Charles Boyd, age 18, a shoemaker, came under my care May 24, 1858. He had had a cough for three months, attended with emaciation and night-sweats. Slight dulness existed at the upper portion of the right lung, also crackling and prolonged expiration; a friction sound was noted at the upper portion of the left lung, anteriorly, near the second rib, and dry râles were heard there, as, indeed, over the entire extent of that lung and of part of the right. The case was diagnosed as one of tuberculosis, probably of both lungs, certainly of the right, accompanied by an attack of bronchitis. The bronchitis soon yielded to remedies employed for its removal. On the 8th of June, no râles were perceived. There was then crackling in the right lung, rude inspiration, with marked prolonged expiration; whilst in the left lung the respiration was harsh, the friction sound being still heard; also—what previously (although it may have been present) had not attracted attention—*a rather short blowing sound,* at times of high whistling pitch, then again of a lower note, in the second intercostal space, and synchronous with the heart's impulse. No blowing sound existed over the heart; nothing abnormal was noted about the impulse or size of the organ. The further history of the case, until the patient was lost sight of (in September), is soon told. The crackling at the upper portion of the right lung became larger and moister, and more decided signs of infiltration in the left lung took place. When last seen, the blowing sound in the pulmonary artery still existed, and, under excitement, was almost distinctly sibilant; it was heard best when the patient held his breath in expiration.

Both these were undoubtedly cases of phthisis. The blowing sound in neither, from their not having been under observation when first attacked, can be stated to have occurred with the earliest indications of tubercular infiltration. In the two cases which follow—and for the opportunity of recording which I am indebted to my friend, Dr. Francis W. Lewis—the blowing sound was noticed when the signs of disease of the lung were far from being satisfactory, or even unequivocally present, but the progress of the cases showed it to be associated with tubercular disease. In Cases V. and VI. which are still under observation, the physical signs and symptoms indicate phthisis in its earlier stages, and the blowing sound is, in both, quite distinct.

Case III. In the spring of 1854, I saw several times, with Dr. Lewis, Hugh Burns, æt. 28, a coachman, who had the physical sign in question very well marked. He had consulted Dr. Lewis in March, 1853, for cough and dyspnœa. He was then a man of florid appearance, not in the slightest degree emaciated, but very much addicted to the use of tobacco. He complained of having suffered occasionally from palpitation of the heart, had a slight cough, and had had a hemorrhage from the lung about a fortnight before. The physical signs at that time were negative as to a deposit. No abnormal modification of the vesicular murmur was found in the right lung; if any existed in the left, it was obscured by a very distinct, rather harsh blowing sound, heard to the left of the sternum. The patient was placed upon the use of cod-liver oil. When he was again seen, six months afterwards (in September), he had had several hemorrhages. The left lung was evidently the seat of a tuberculous deposit. I examined him about this time; he was somewhat emaciated, coughed, and presented dulness at the upper portion of the left lung with harsh inspiration. The *blowing sound* was very distinct, especially after exercise. When the heart was acting quietly, it was softer, and not always easily perceptible. Its situation was at the left of the sternum in the second intercostal space; it extended from thence slightly upwards, and occurred synchronously with the impulse of the heart. There was no enlargement of the organ, no blowing sound over the heart or in the arteries of the neck. The further history of the case showed that the tubercle gradually infiltrated both lungs, cavities formed at the apices, dysenteric complications occurred, and the patient died exhausted on September 19, 1854. The blowing sound had not disappeared when his chest was last examined, after cavities had fairly formed, and when he was sinking. Subsequent to this, he grew so weak, that an accurate examination of the chest could not well be made.

Case IV. Sarah Gray, æt. 36, married, of scrofulous aspect, had been salivated severely for rheumatic iritis, after which she fell at once into feeble health. Her symptoms, when seen on March 3, 1853, may be briefly stated as follows. She was emaciated, coughed, the circulation was feeble and irregular, and her menses had stopped. A physical examination revealed slight feebleness of respiration at the upper anterior portion of the left lung, and a distinct *systolic blowing sound* at the base of the heart, not propagated into the aorta, and not heard in the vessels of the neck. It could be localized near or over the sternum, opposite the third rib. The heart's action was frequent, and the impulse strong. In July, unmistakable signs of tubercular deposit appeared in the left lung. She grew weaker and weaker, and died in January, 1854. The blowing sound was distinctly heard a few weeks before her death. An autopsy showed extensive disease of the left lung. It was, throughout, the seat of a tubercular deposit, and contained cavities. The right lung presented only a few scattered tubercles. None of the abdominal viscera were affected. The heart was not enlarged, the valves were healthy. No abnormal state of the pericardium, nor of the vessels proceeding from it, was noted. The exact position of the pulmonary artery to the deposit was, owing to the circumstances of the examination, not specially studied.

Case V. Sarah C——, æt. 47, consulted me October 30, 1858, with reference to a cough which she had had for nine months. She had lost flesh and had spat blood twice within the last week, not much in quantity, but red and unmixed with expectoration. Occasionally she has had night-sweats. The cough was very troublesome, especially when she laid down at night. The appearance of the woman was not that of anæmia. She did not complain of shortness of breath; her respiration was not hurried; there was no pain at any portion of the chest. On percussion, I found general clearness throughout both lungs; but at the upper portion of the left lung, anteriorly, especially between the second and third ribs, slight dulness was noticed, and an increased resistance to the finger. On close inspection, a sinking in at the upper portion of the lung was observed. In the right lung the vesicular murmur was normal; in the left lung the respiration throughout the whole upper portion of the chest, anteriorly and posteriorly, was rude; rudest, however, at the apex, anteriorly. The heart's sounds were normal; the impulse and the extent of percussion dulness not increased. Between the second and third ribs, an inch to an inch and a half from the edge of the sternum, on the left side, was heard with each beat of the heart a rather abrupt but *distinct soft blowing sound;* after it, an accentuated second sound. The murmur was not perceived at all over the heart, nor even at the left edge of the sternum. It did not extend up higher than the second rib, and was not heard with each impulse. No blowing sound existed over the aorta. No venous or arterial murmurs were discerned in the neck. The sound seemed only to be occasionally produced, and was best heard at the first few minutes of the examination; after that it was not constant. The patient complained of some pain on pressure between the first and second, and second and third ribs. It was not noticed that any acts of respiration caused marked changes. The blowing sound seemed to be more particularly distinguishable after a series of full inspirations, and to be in time simultaneous with the expiration.

Case VI. James Dogherty, age 18, is noted in November of this year as having been ailing for nine or ten months with pains in the chest and a cough. He is very liable to colds, and then the cough increases. At no time since February has he been free from cough. He has lost flesh, and has on several occasions expectorated blood, upwards of a tablespoonful in quantity; yet he neither looks, nor expresses himself as feeling very feeble.

On examining his lungs, the left lung yielded at the upper portion a somewhat duller sound than the right; the respiration at the whole of the upper portion of the left lung, anteriorly, was rude.

The percussion dulness over the heart was more extended than usual; the impulse also was stronger. The sounds at the apex of the heart, and at the aortic cartilage, were normal; at the pulmonary valves (edge of the sternum, left side) the second sound was much accentuated; between the second and third ribs, about an inch from the edge of the sternum, was discerned, with the impulse of the heart, a *short, rather musical blowing sound,* over a space which could be covered with the stethoscope. The sound was best heard when the patient was standing erect, and at the commencement of the examination. It seemed also most distinct after a full inspiration. When he was quietly seated, the sound was not perceived. No venous or arterial murmurs were observed.

That these patients all suffered from phthisis need hardly again be stated. In all of them the blowing sound existed, unconnected with blowing sounds in the heart, or in the arteries of the neck. In all, the blowing sound was synchronous with the impulse, and in five, situated in the second intercostal space. In reviewing these six cases, we are struck with the fact that the murmur was evidently among the earlier symptoms in four; and further, that although it was not always equal in intensity, as far as observed it did not disappear entirely. But on this point I do not wish to speak decidedly, since some of the cases have not been watched long enough to permit of a conclusion. In the last two observations some room for doubt as to the correctness of the diagnosis may exist, but not much; not more than is present in any case of incipient pulmonary disease in which there has been hemorrhage, and in which slight dulness, with a modification of the vesicular murmur, is detected at the apex of the lung. Were it not from having observed the next two cases, I might have arrived at the conclusion that a blowing sound in the second intercostal space absolutely belongs to tubercular infiltration of the lung; but they disapprove this idea, and show how the sound may be associated with other than tubercular affection.

Case VII. Ter. McGinnis, age 33, a labourer of healthy appearance, consulted me in August, 1858, for fugitive pains in the chest, especially of the left side. His case is noted as follows: In December, 1857, having previously been in excellent health, he was seized, after exposure, with a fever and severe pain in the left side, which confined him to his bed. His breathing at that time was short, but he recovered from the attack without any further annoyance than an occasional cough and some pain in the chest. He has not lost any flesh; never spat blood; and has no cough; indeed, with exception of the pains which trouble him occasionally, he is in good health. Neither his respiration nor his circulation is increased in frequency, nor has he difficulty of breathing. The upper part of the left lung, anteriorly, is duller on percussion than the upper part of the right. The inspiratory murmur throughout the left lung, but especially at its upper portion, is harsh; the expiration there prolonged. The voice is distinctly heard over the left lung. Vesicular murmur is normal throughout the right lung. Size of the heart normal; sounds normal; at the left side of the sternum, between second and third ribs, the second sound of the pulmonary artery is remarkably accentuated and sharp sounding, much more so than the aortic on the opposite side; in a line more outwards a short *distinct blowing sound* is heard, corresponding to the impulse of the heart, over a spot about an inch in length; it is marked when the patient is in the erect position, and the heart is beating strongly.—He was directed to rub his chest with a stimulating liniment, which relieved the pain.

On September 28, the physical signs were the same; his general health was good, and he was able to do his work. The blowing sound was heard well when the heart was acting rather strongly. I have seen him once since; he was attending to his daily duties, and in good health. No murmurs in the arteries or veins of the neck were at any time perceived.

Case VIII. A—— C——, age 22, consulted me in September, 1858, for a pain in the chest and a cough which he had contracted at a watering-place.

The physical signs indicated slight bronchitis of the right lung. The pain was mainly post-sternal. The cough was trifling, and, under the use of expectorants and a turpentine liniment, both it and the pain had in the course of three weeks entirely disappeared. The previous health of the gentleman had been excellent. He did not recollect ever to have had an acute disease of the lung. No hereditary tendency to tuberculosis existed in the family. He had, when last examined (November 17), not a vestige of cough remaining, and was in very good health, excepting a slight enlargement of the tonsils, and sore-throat, which has at times troubled him for years past. When first ausculting his chest, I was struck *with a distinct blowing sound* in the second intercostal space of the left side. It was soft, low-pitched; but became, when he was breathing frequently and his heart was excited, of a higher pitch, and more like a sibilant râle. The sound was noted at his first examination; at the last, two months afterwards, it was still present. Its more particular character may be gleaned from a note taken during one of the examinations after the signs of bronchitis, and the cough had entirely left.

On percussion, the lungs are clear throughout. There is relative dulness, with a higher pitch at the upper portion of the left lung. This is especially marked between the second and third ribs, where there is also more resistance, and a slight sinking in perceptible. On auscultation, the vesicular murmur is normal throughout the right and the greater portion of the left lung. At the upper portion of the left lung it is harsher and stronger than normal, although the expiration is not prolonged; between the second and third ribs it is feebler than higher up; and the inspiration is distinctly jerking, or rather divided. The percussion dulness of the heart is not marked until the fourth rib is reached. The impulse is natural in extent, force, and situation. The heart-sounds, at the apex, at the ensiform cartilage, and close to the sternum on the right side in the second intercostal space, are natural; on the left side, about half an inch from the sternum, in the same intercostal space, is heard a blowing sound, corresponding to the impulse, and followed by a very accentuated and marked second sound, which is more accentuated and marked than the second aortic sound. When the heart, after exertion, is beating rather strongly (the pulse counted being 78), and the breathing hurried (28 times a minute), the blowing sound becomes like a sibilant râle. It is best heard when the expiration is held, or immediately after the inspiration. When a long breath is drawn and held, the murmur can hardly or not at all be discerned, and the second sound is very indistinct, but becomes afterwards, during expiration, very sharp and distinct. The sound has the sibilant character only very occasionally if the heart is beating quietly and the breathing not hurried. Under these circumstances, also, it cannot be readily perceived with every impulse of the heart. Over the spot indicated no other sound occurs, corresponding in time to the first sound of the heart, and no pain or pulsation exists.

No blowing sound could be discerned in the arteries or veins of the neck.

The *physical sign* in question may, then, be stated as being a murmur attending the impulse of the heart, almost always soft and low-pitched, although occasionally harsher, of higher pitch, and simulating a sibilant râle. Its situation is in the second intercostal space on the left side, not an inch from the edge of the sternum. It may be audible higher up; or, again (as in Case IV.), opposite the third rib, on the sternum.

The space it occupies is usually very limited, and can be accurately circumscribed with the stethoscope. It is not heard during a full inspiration, but very distinctly after inspiration, or with expiration. It takes the place of the first sound at the spot it is heard, but is followed by a distinct second sound. When the patient is breathing quickly, and the heart's action excited, it is best distinguished. It is not always of equal distinctness or of equal pitch, but it is not transitory, as it may be observed extending over a long space of time. The sounds of the heart are not influenced by it. They are heard with the usual clearness at the apex, immediately above the ensiform cartilage; at the third rib, or second intercostal space, on the right side; at midsternum; and even at the third costal cartilage and edge of sternum, on the left side. At this latter situation the second sound is distinctly heard; the occurrence of the first is more difficult to perceive and more doubtful.

Before inquiring into the cause of this sound it will be necessary briefly to recall the anatomy of the parts, as well as some clinical points with reference to examinations of the heart. If a long needle be stuck into the chest, in the second intercostal space on the left side, immediately below the cartilage of the second rib, it strikes the pulmonary artery near its bifurcation. The valves of the pulmonary artery are seated at the junction of the cartilage of the third rib with the sternum on the left side. Near them, somewhat lower, lie the aortic valves; and lower still, and inwards, about on a level with the fourth rib, at midsternum, are the tricuspid and mitral valves. The fact that the valves are so close together has led to the seeking for points at which the sounds may be isolated, and these are, following the course of the vessels, for the aorta, the second intercostal space close to the right edge of the sternum, or the second costal cartilage; for the pulmonary artery, from its ascending on the left side, the second costal cartilage, or the second interspace near the left edge of the sternum. These points for the aorta and pulmonary artery are spoken of, for convenience sake, as the "aortic cartilage" or interspace, or the "pulmonary cartilage" or interspace. Now, the pulmonary artery is inclosed in its whole extent by pericardium, within which membrane it usually divides. The left pulmonary artery passes then through the pericardium, a layer of which is prolonged upon the vessel; surrounded by this and the reflection of the pleura, it is met with at the root of the lung. It, however, soon enters the pulmonary texture and subdivides, at a point immediately over the fourth dorsal vertebra, and, as may be readily seen by removing the sternum, opposite the junction of the lower border of the second costal cartilage with the corresponding rib.

As the blowing sound is heard so exactly in the position which we have just seen to indicate the course of the pulmonary artery, and especially at a point just before or even at the bifurcation of its left branch, we shall regard its seat as certain, and may next proceed to discuss its *cause.*

All blowing sounds in the heart or in arteries are due either to a peculiar condition of the blood, or to the presence of local obstructions; or, again, they may be transmitted. This latter supposition cannot be entertained, as there was no murmur anywhere to be transmitted, the heart in all the eight cases yielding perfectly normal sounds.

Was the murmur inorganic, the blowing sound that of anæmia? No; for, independently of the fact that in Cases VII. and VIII., as well as in Case III. when first seen, not the slightest signs of anæmia existed, it is in nearly all especially noted that there were no blowing sounds in the arteries of the neck, or none of those venous murmurs which usually occur in watery states of the blood. I am aware that a blowing sound in anæmic women may be more marked at the base of the heart over the pulmonary artery than over the aorta; but is it persistent, merely distinguishable there and unaccompanied by a venous hum? Certainly this must be of very rare occurrence. In Case IV. the blowing might be thought to have been inorganic, from the history of the case, and from its being perceived near the sternum; but even here its purely local character, and the absence of murmurs elsewhere is against this supposition, and still more so is it in the other cases.

If the blowing sound was not inorganic, and not transmitted, it must have been owing to local lesions of the pulmonary valves, or of the artery. Now, morbid states of the pulmonary valves occur so rarely, as hardly to be considered in a point of diagnosis. Moreover, the site of the greatest intensity of the blowing sounds in such cases would be at the sternal edge of the third left cartilage, which it was not in the cases reported, excepting, perhaps, in one; in which, however, an autopsy demonstrated the absence of valvular lesion. Nor were there in any of the patients signs of cardiac disturbance; hence, diseases of the pulmonary valves certainly could not have been the cause of the murmur.

The last consideration, is that the murmur was caused by local changes or obstructions in the pulmonary artery. This might be owing to deposits in the coats of the vessels, or to a healthy state of the artery itself, the murmur being produced by pressure on the artery. That it was the latter, and not the former, I believe, because,

1st. Deposits in the coats of the pulmonary artery are uncommonly rare.
2d. The cases having occurred mostly in young persons, the age of the patient excludes deposits.
3d. The murmur was usually soft, but became sometimes of a more whistling character.

On this point I lay less stress, but the other two are sufficient. It might also be added, that the autopsy in Case IV., whilst it is not satisfactory as to the exact condition producing this blowing sound, is so, as far as it showed no abnormal state of the coats of the vessels.

These blowing sounds are, then, capable of explanation by local pressure, or rather a want of yielding of the textures surrounding the left pulmonary artery, or one of its branches, during the diastole or expansion of the vessel, and when the blood is propelled through it. Masses in the pericardium have been noticed to produce a murmur in the pulmonary artery. Why should not, then, in some persons, in whom the position of the artery is such as to be easily compressed by the lung, infiltration of the surrounding textures—especially if pleuritic adhesions exist at the upper lobe, which would keep the lungs from fully expanding—prevent the vessel from fully and equally distending, and thus give rise to a murmur? This might occur the more readily, because, as will be presently shown, the first sound at the pulmonary artery is usually dull and indistinct, and would easily permit of a murmur being perceived or taking its place. Whether this explanation be adopted or not, the fact that in all the eight cases local signs of partial consolidation were met with, seems to bring these local signs in connection with the peculiar murmur. I do not claim to have discovered a new physical sign. My only wish has been to endeavour to fix the value of a sign which experience has taught me occurs in a certain number of cases. Dr. Latham, long ago, pointed out the occurrence of a blowing sound at the upper part of the left lung, in persons who were undeniably tubercular, or suspected of being so. From some reason or other, little heed has been taken of his observation; but that it is entitled to consideration the cases reported prove, although they also prove that non-tubercular deposits may occasion this murmur. On the whole, however, they show that where slight changes are observed at the apex of the left lung, with symptoms which lead to a suspicion of tuberculosis, where there is an absence of any symptoms or signs which point to a previous attack of pleurisy or pneumonia, and which would account for the physical signs at the apex, the presence of a *localized* systolic blowing sound on the left side, unaccompanied by venous murmur, ought to have a decided diagnostic significance: in what proportion of cases it occurs remains, however, yet to be fixed.

In the course of this clinical inquiry, two points have arisen on which some light may be thrown by a comparison with phenomena in health. The blowing sound took the place of the first sound over the pulmonary artery. What are the natural sounds heard there, and how produced? Secondly, full inspiration prevented the sound from being heard. What is the effect of full inspiration on the sounds of the artery?

For the purposes of an accurate standard in examinations of cardiac affections, I have studied and compared with each other, with care, the heart sounds in the different portions of the organ, and also the effect of the respiration on them. I shall insert here as much as is relevant to the subject of the consideration of sounds in the pulmonary artery, merely adding that the usual clinical positions have been selected—the second intercostal space near the sternum, on the right side, for the aorta; on the left, for the pulmonary artery; whilst the sounds at the apex have been studied a little above the left apex, and above the ensiform cartilage. Where the term apex merely is used, it is meant to apply to the apex beat on the left side of the heart, between the fifth and sixth ribs.

Comparative Observations on the Sounds of the Pulmonary Artery.

Observations.	Sex.	Age.	Pulse.	Respirations per minute.	Character of sounds of pulmonary artery.
1	M.	12	72	19	First sound very dull, indistinct, of much lower pitch than second, which is sharp and accentuated and very marked at left edge of sternum.
2	M.	22	70	24	Sounds in all respects the same; no difference between aortic and pulmonary; first sound at the left apex is much longer.
3[1]	F.	24	96	25	Both sounds distinctly heard; first sound of low pitch; second sound unusually strong and accentuated. As compared with the aortic sounds, the first pulmonary was of lower pitch, but the second seemed in all respects equal. The first sound at the apex was very much longer and more weighty.
4	M.	13	80	23	Both sounds heard; first, dull, of low pitch; as compared with aortic, second aortic is much more distinct; no difference between the first.
5	F.	15	75	20	First sound very dull, of low pitch, and very indistinct; second sound sharp.
6	M.	22	80	19	First more like an indistinct vibration, of low pitch, no defined sound heard; second, sharp, accentuated, best heard at left edge of sternum; first aortic, also, is very dull; second more marked than second pulmonary; first sound at apex long, heavy and distinct.
7	M.	30	72	20	Both sounds distinct; first much duller than second, which is most accentuated at edge of sternum; second aortic more accentuated than second pulmonary; no difference between first.
8	M.	22	50	15	First sound very dull, almost imperceptible; second marked, most so at edge of sternum. As compared with aortic sounds, first duller, of lower pitch, but more prolonged; second less accentuated. At apex of heart, first sound is dull, heavy, and long.
9	M.	26	72	20	First sound indistinct, dull, of lower pitch, less sharp than first aortic. Second not nearly as accentuated as second aortic. First, at apex, dull, but heavy and prolonged.
10	M.	23	72	20	The same results.
11	M.	25	74	24	Both sounds distinct; first is rather duller, longer, and of lower pitch than first aortic, but as distinct or distincter; second aortic is sharper and more accentuated. First, at apex, dull, but very distinct, heavy, and longer than first pulmonic: first, at ensiform, rather sharper.
12	M.	26	72	19	First sound dull, but of low pitch; duller than first aortic. Second also less sharp and accentuated than second aortic. At apex, first is much heavier and prolonged.
13	M.	22	84	18	The same; except no appreciable difference between first aortic and first pulmonary. First, at ensiform, sharper than first pulmonary.
14	M.	21	96	19	The same as in Observation 12. First sound of pulmonary artery is not as sharp, and more difficult to distinguish, than first aortic.
15	M.	25	96	21	The same. First of pulmonary artery very dull and of low pitch, more like an indistinct vibration. First, over ensiform, sharper.
16	M.	24	72	18	First sound dull, low pitched, and so indistinct as to be almost imperceptible. Second accentuated and distinct, but not as much so as second aortic. First aortic, also, is sharper and better marked; sounds shorter. At apex, first sound is dull, prolonged, but not very heavy.
17	F.	44	82	25	First sound at pulmonary dull and indistinct; second marked, less accentuated than second aortic. No difference between first pulmonary and first aortic. First, at apex, is dull, much more prolonged, and heavy; and very distinct.
18	F.	30	72	20	First sound at pulmonary dull, but marked; no difference between it and aortic first; seems a little more distinct. Second pulmonary more marked than second aortic. First, at apex, dull, but very much more distinct and prolonged than first pulmonary.
19	M.	58	70	19	First sound at pulmonary very dull, low pitched, indistinct, hardly perceptible; second marked, but far less so than second aortic. First aortic sharper, higher pitched than first pulmonary. At apex, first is much more prolonged, quite distinct, and heavy.
20	M.	22	76	24	First pulmonary indistinct and dull, more so than first aortic. Second pulmonary less accentuated than second aortic. First, at apex, dull, but distinctly heard; much longer than first pulmonary.

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[1] This person was troubled with occasional shortness of breath, but the size of the heart was not increased, the beat was frequent, the impulse distinct.

It will be seen from this table, that the first sound of the pulmonary artery is usually dull, of low pitch, and, in certain cases, more like a vibration than a sound, or so indistinct as hardly to be perceptible. Compared with the first sound of the aorta, it is equal in a certain number of instances (it was in six out of eighteen in the table); but when it differs (in eleven out of eighteen), it is noticed to be less distinct, less sharp, although, it is in some persons a rather longer sound. Compared with the first sound at the apex of the heart, it lacks the weighty, prolonged, marked character of this sound. If the stethoscope be carried up from the apex of the heart to the second interspace, the difference is observed to be very marked; the change of sound occurs almost abruptly. It seemed to me, also, as if a decided change in pitch took place; but I do not wish to speak too positively on this point, as it is a very difficult matter to distinguish changes of pitch in sounds, both of which are dull, and one very indistinct. Compared with the first sound over the right ventricle (above the ensiform cartilage), the first pulmonic is of a much duller character, and decidedly less sharp, and not of as high a pitch. In this respect, the difference—not merely in the above observations, but in others I have made—was noticed as much more decided than between it and the first sound over the left ventricle; the one on the right side being, although less strong and shorter, usually clearer, and of higher pitch even than this.

These analyses, showing that the sounds of the heart, listened to in different positions, differ in character, are thus in favour of the view that the first sound of the heart, as heard over the arteries, is not merely a transmitted sound, but is one which—to a great extent, if not entirely—is generated by the coats of the vessels themselves during their diastole. They would further tend to show that the first sound of the heart, as heard over the apex on the right side, is not transmitted from one side to the other, but is formed by each ventricle separately.

As regards the second sound in the pulmonary artery, as compared with the second aortic sound, it need only here be said that the latter is usually far sharper and more accentuated. Out of the eighteen cases compared, it was stronger in fifteen, equal in two, less marked only in one.

A second point with reference to the blowing sound capable of being somewhat elucidated by a comparison with health was, why was it inaudible during a full inspiration, and so marked in expiration? The following table, by exhibiting what effect a full inspiration has on the sounds of the heart in health, will explain it, especially if, in addition, it be borne in mind that the sound is sometimes of the same pitch as the inspiratory murmur, and that in expiration the heart's action is quickened. Ten young adults were selected, whose hearts, as far as the extent of percussion-dulness, rhythm, and impulse, proved, were perfectly normal.

Effect of a full Inspiration (the breath being held) on the Heart.

	At, or rather somewhat above, ensiform cartilage.	At apex of heart.	Second interspace on right side between cartilages.	Second interspace on left side of sternum.	Effect on impulse, and extent of percussion dulness.
1	Both sounds somewhat lessened; first most.	Both sounds much lessened.	Both sounds somewhat lessened.	Neither sound heard; second occasionally, but only very faintly and distantly.	Impulse of heart moves downward and inward towards median line; at previous seat of impulse, impulse is very feebly felt.
2	First disappears; second is heard tolerably distinctly, not quite as distinctly as previously.	The same.	First sound disappears; second faintly and distantly heard.	The same.	The same; the extent and shape of percussion dulness alters; at the upper border, it shifts nearly an inch; sounds heard distinctly over the shifted impulse.
3	First sound more indistinct; second not much changed.	Both sounds almost disappear; second least.	The same.	Nothing heard.	The same.
4	First lessens; second seems to gain.	The same.	The same.	First disappears; second heard only faintly.	The same.
5	The same.	Second disappears, in proportion, more than first.	The same; second not heard.	The same.	The same; dulness moves by an inch.
6	The same.	First disappears almost entirely; second can be heard, although faintly.	First disappears entirely; second heard as a small tick.	Both disappear.	The same; dulness moves by three-quarters of an inch.
7	Both sounds heard but are somewhat lessened.	Both sounds somewhat lessened.	First sound disappears; second heard with tolerable distinctness.	First disappears; second very faintly heard.	The same.
8	Both sounds heard; no change.	First sound duller, less distinct; second hardly heard.	First sound does not disappear, although very indistinct; second, only slightly less distinct, is well heard.	The same.	The same.
9	First sound lessened; second seems to increase.	Both sounds lessen; first proportionably most.	First disappears; second well heard.	The same; second, however, is distinguishable.	The same.
10	Sounds not much lessened.	Both sounds become very indistinct.	The same; second does not disappear, somewhat lessened.	The same; second very faintly heard.	

These observations, which have been repeated on other cases with similar results, show, then, the effect of a full inspiration on the heart sounds to be an almost entire disappearance of the sounds heard at the interspace between the second and third ribs on the left side, and a very great, but not as marked a diminution of the sounds at the aortic cartilage. At the apex, the first sound lessens very much, and becomes in some persons almost imperceptible; the second also is modified, but proportionally less than the first. Over the ensiform cartilage, the sounds lessen least. Indeed, the second sound, in four cases out of ten, was distinctly increased; and in two cases, in which the first sound became much more indistinct, the second was heard almost unchanged. These changes were all noticed in those who were capable of taking a very full inspiration and holding it for some time, and were constant on repeated examination. I believe, although the proximity of the valves to each other renders it impossible to speak conclusively, that this accentuated second sound, heard at the spot mentioned, is that of the pulmonary valves, and has become more marked, owing to the fact that during a full inspiration, the heart's action is slower, more laboured, and the circulation of the lung probably interfered with; thus, the pulmonary artery would be distended, and the backward stroke of the column of blood against the semilunar valves be more forcible.

The fact that the heart sounds are in a full inspiration less distinctly heard at points at which they were previously well perceived, may be explained by the lung being carried in front of the heart, which it does more on the left than the right side, and, to some extent, by the relative displacement which occurs during the act of inspiration. The apex, especially, is displaced; it moves down in some persons, by several inches, towards the pit of the stomach, and becomes almost imperceptible at its previous point of impulse. This displacement seems to me to be brought about, not only by the depression of the diaphragm, but by the pressure of the lung on the left side of the heart, a fact of which I have convinced me by observations, which it is only necessary here to allude to, and which will be found elsewhere detailed.[1]

Art. IX.—*Notes on the Medical Topography, Climate, and Diseases of Panama, N. G.* By Wm. P. Buel, M. D., Surgeon Pacific Mail Co.

The city of Panama, by reason of its geographical position, historic associations, and commercial importance, is an object of interest to the philosopher, the statesman, and the man of science. Planted on a narrow neck of land, which connects two great continents, and separates two mighty oceans, it stands like a gateway, through which must pass a great amount of the world's commerce. Already it has regular steam communication, on the east with England, the United States, the West India Islands, and the Atlantic ports of South America; on the west with all the principal ports of the South Pacific; with Central America, Mexico, California, Oregon, and the British possessions. At no remote period, Australia, the Sandwich Islands, and China, will be added to this already extended list.

Topography.—The present town of Panama is situated in lat. 8° 57′ N., and lon. 79° 31′ W.; in the northern half of that tropical belt which supplies us with coffee and sugar; spices and dye-woods; cinchona and

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[1] See Transactions of the College of Physicians of December 1st.